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# Myomectomy: Surgical Techniques Anno 2018, A Systematic Review

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## Abstract

**Background:** The aim of this article is to provide a practical evidence based manual of the potential surgical techniques for a myomectomy, anno 2018: minimal invasive surgery (laparoscopy versus robotic assisted laparoscopic surgery (RALS)) and laparotomy.

**Materials and methods:** A literature review has been performed for approach, choice and correct use of instruments, procedure and closure of wound bed in the field of a myomectomy. A thorough web research showed a disappointing amount of evidence based facts regarding accurate surgical steps to take in this matter. The missing information is added as a suggestion based on the surgical technique used in a tertiary referral center in Belgium.

**Results:** A myomectomy is a procedure performed in women with a desire to retain their uterus. The myoma is preferably vertically incised in the midline to prevent transection of the arcuate arteries of the uterus. The location of a fibroid, and not its size, is the key factor regarding impact on fertility. The main goal of the procedure is to remove the fibroid in total without opening the intra-uterine cavity. With intramyometrial injection of a vasoconstrictor blood loss during myomectomy can be significantly reduced. Uterine reconstruction is performed in multiple layers with a continuous barbed which does not require knotting. In women with child wish one can discuss leaving hyaluronic acid (Hyalobarrier) on the wound bed in order to reduce postoperative adhesions and secondary impact on fertility.

**Conclusion:** A correct indication of surgery is primordial in advance in order to reduce complication rate and risk of conversion. At the moment minimal invasive approach (either laparoscopic or robotic) has proven to be superior over open surgery in benign gynaecological pathology. There is a significant overlap in indication with laparoscopic approach, however in this topic of minimal invasive surgery, studies lack evidence of robotic ruling over laparoscopic approach.

## Keywords

Myomectomy; Laparoscopy; Robotic surgery; Laparotomy

## Abbreviations

| | | |
|---|---|---|
| RALS | : | Robotic Assisted Laparoscopic Surgery |
| BMI | : | Body Mass Index |
| SIAS | : | Superior Iliac Anterior Spine |

## Objective

The aim of this article is to provide a practical manual of the potential surgical techniques for a myomectomy, anno 2018. This article only focuses on the procedure of a myomectomy and the position of minimally invasive surgery (laparoscopy versus RALS) and laparotomy in this matter.

## Materials and Methods

A literature review has been performed for approach, choice and correct use of instruments, procedure and closure of wound bed in the field of a myomectomy procedure in order to develop a up-to-date practical manual for gynaecological surgeons. This article only focuses on the procedure of a myomectomy and the position of minimal invasive surgery (laparoscopy versus RALS) and laparotomy in this matter. For topics that lack evidence based medicine the preferred technique described is a suggestion based on the practice in a tertiary referral hospital in Belgium. The robotic assisted laparoscopy is performed using the Da Vinci surgical system (Intuitive Surgical), which is operational after its approval in 2005.

In the beginning of this decade robotic surgery has developed as a more technologically advanced form of minimally invasive surgery in order to improve patient outcome. Anno

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2018, indications of RALS in benign gynaecological surgery are myomectomy, hysterectomy, abdominal cerclage and pelvic organ prolapse repair [1]. There is a significant overlap with laparoscopic approach in previous mentioned indication list, however main targets of RALS are those complex cases that mitigate the limitations of conventional laparoscopy.

The risk of conversion from robotic approach to laparotomy (complication) is overall low and depends on patient's BMI, previous laparotomy, history of asthma, single port approach and surgeon case volume [1].

While laparoscopic technical skills are needed for successfully completing robotic procedures, there are many other aspects that need extra attention to ensure a smooth operation. Optimal patient positioning and port placement is to robotic surgery as good operative field exposure is to open surgery. Without good patient positioning and well placed laparoscopic ports, the quality and ease of robot-assisted surgery will definitely become compromised [2].

Single port access is a new upcoming technique and is excluded in this article as this is a whole different approach and counts as a risk factor for conversion to laparotomy [3].

These articles will provide a practical tutorial for removal of FIGO 4-5-6 fibroma (Figure 1). As you can see on Figure 1, removal of FIGO 1-2-3 situated fibroma is best performed by transvaginal approach. Solitary pedunculated myomas (FIGO 6-7) can be easily separated from the uterus by ligation of the pedicle. A procedure that does not require much expertise . Extra-abdominal removal of the resected myoma is the most challenging part. Enucleation of FIGO 4-5-6 fibroma on the other hand is a frustrating, time-consuming procedure that requires surgical expertise. The myomais preferably vertically incised in the midline to prevent transection of the arcuate arteries of the uterus, which run transversely [4].

The location of a fibroid, and not its size, is the key factor regarding impact on fertility [5]. It is primordial to handle ovaries and tubes, mainly tubal cornua, with care to not impair fertility. As myoma can cause pelvic anatomy distorsions, course of ureter may not be out of sight at all times during the procedure. In the next chapter the three different surgical approaches are handled in detail.

## Results

A myomectomy is a procedure performed in woman with a desire to retain their uterus for example in fertility context. A pregnancy test needs to be performed pre-operatively to exclude early pregnancy. The procedure is ideally performed prior to ovulation.

Patients are allowed to eat or drink until midnight on the day of surgery. They are admitted in hospital late afternoon one day prior to the surgery where bloods are taken to rule out anemia (as hypermenorroe with secondary anemia is one of the main indications for this surgery) and proper bowel preparation can be started. If necessary a blood transfusion can be arranged depending on laboratory results. 2 units of packed cells are always reserved during the surgery. Patients receive one dose of antibiotics (cefazoline) prior to the surgery.

It is primordial to perform a bimanual clinical assessment of the pelvic organs once the patient is under general anesthetic in order to answer following questions: how mobile is the uterus? Will the size of the uterus/myoma allow adequate vision? is the scheduled approach still possible?

If those questions can be answered positively, the patient can be prepped for surgery.

A bladder catheter (Foley) is always put in place during surgery to avoid bladder distension and can be removed once the patient is mobile after surgery.

The vagina should be disinfected in the subsequent case that the cavity and or vagina would be opened during surgery, which can be a risk factor for ascending infections. The main goal is to remove the fibroid in total without opening the intra-uterine cavity. Entrance of the uterine cavity can be detected due to the different texture and color of the endometrium. In case of doubt, methylene blue can be placed into the cavity using a intra-uterine catheter so the dye can be seen intra-abdominally.

At the end of the procedure it is primordial to abundantly irrigate the pelvis and abdomen and suction of the fluid in order to reduce the risk of parasitic myoma (FIGO 8) [6] and take measures discussed above to prevent adhesion formation.

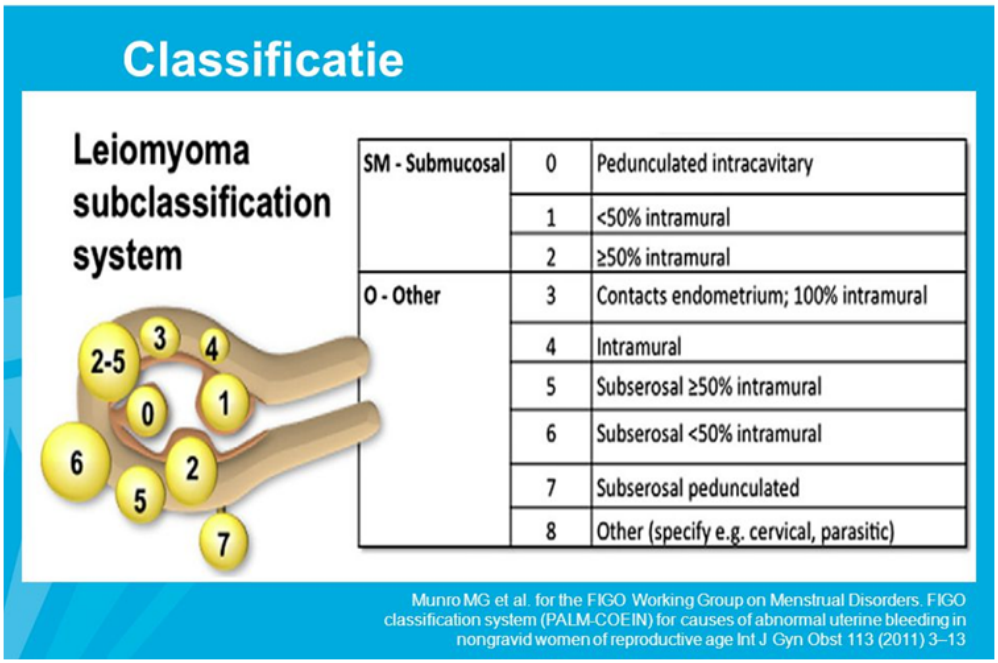


**Figure 1:** FIGO classification of myoma.

In women with childwish, one can discuss leaving hyaluronic acid(Hyalobarrier) on the wound bed in order to reduce postoperative adhesions and secondary impact on fertility. While these strategies (improving surgical techniques, optimizing laparoscopy conditions, using pharmacologic interventions targeted at the inflammatory response and/or fibrin deposition, and using agents that provide a physical barrier to adhesion formation) have provided some success, none have yet proven totally successful in abolishing adhesions. Further research to ensure that adhesion prevention is optimal is therefore essential [7].

## Robotic assisted laparoscopic Myomectomy

**Installation:** The patient is positioned in lithotomy position (45° pelvis-leg) with the coccycal bone on the edge of the operating table. A uterine manipulator can be positioned in order to enhance uterine mobilisation and therefor surgical field vision.

**Approach:** Unless the benign gynaecological pathology is reaching until the umbilicus, the umbilicus is the easiest site of entrance to develop a pneumoperitoneum until 15mmHg using a verres needle. The robotic 0 degree laparoscope has a 8 mm diameter. One who does not feel comfortable using a Verres needle to obtain a pneumoperitoneum, can go for the open umbilical approach however as a maximum diameter of 8 mm is advisable in order to reduce involuntary air leakage, this can be quite challenging using open technique. There is always the possibility to create a fascial layer plication using Vicryl 0 to knot tightly around the positioned port when leakage occurs.

**Instrument Choice and Position:** Once the pneumoperitoneumis in place, a imaginary curved line can be drown from one superior iliac spine, through the umbilicus (unless a more superior point is chosen after bimanual assessment, in that case the line goes through the most superior point) to the opposite superior iliac anterior spine. It can help to use a skin marker to mark the suggested port positions on the abdomen. Ideally the camera is positioned centrally, umbilical, and two extra 5 mm ports can be placed either right or left lower quadrant on the imaginary line, interspace 7-8 cm (palm of a hand) [2]. The patient is then placed in Trendelenburg position (20-30°) and docking of the robot can start.

With unipolar scissors, traumatic grasper, needle driver and energy instruments of choice (like bipolar grasper) on the operating table, the procedure can start.

**Procedure of Myomectomy:** There are many techniques to enucleate myomas. A traumatic grasper is best positioned on the outside port (either left or right) as this instrument will help to optimalise surgical field vision and then left fixed in place. Two active ports stay available on both sides of the camera in order to minimalise the risk of instrument occlusion. After subcapsular infiltration of terlipressin, the serosa and surrounding myometrial shell can be vertically incised in the midline using a fenestrated bipolar grasper and unipolar scissors (Figure 2). The scissors can be used as a cutting device on the tip as well as a coagulation device. The myomas are then extirpated by grasping them with a single tooth tenaculum which is positioned in the outside port and fixed in place while the plane between the myometrium and myoma is further dissected using the scissors (Figure 3). Hemostasis needs to be controlled at all times. Diffuse venous or arterial bleeding can be dissolved using the bipolar coagulation forceps.

A additional 8mm port can be helpful to introduce a irrigationdevice and later in the procedure the suture materials.

**Reduction of Blood loss:** With intramyometrial injection of a vasoconstrictor such as terlipressin, a vasopressin analogue, blood loss during myomectomy can be significantly reduced (299 ml less compared to placebo) [8] and less than or comparable to use of a uterine artery tourniquet [9], temporary blocking blood supply. The maximum safe dose of vasopressin is not established. The half-life of intramuscular vasopressin is 10 to 20 minutes and the duration of action is two to eight hours. We use 0.4 mg of terlipressin diluted in 20 ml saline. Also epinephrine can be used to reduce blood loss, but it has a shorter half-life then vasopressin. Misoprostol was also found to reduce blood loss, but data are limited. There seems no benefit with the use of oxytocin or tranexamic acid [8].

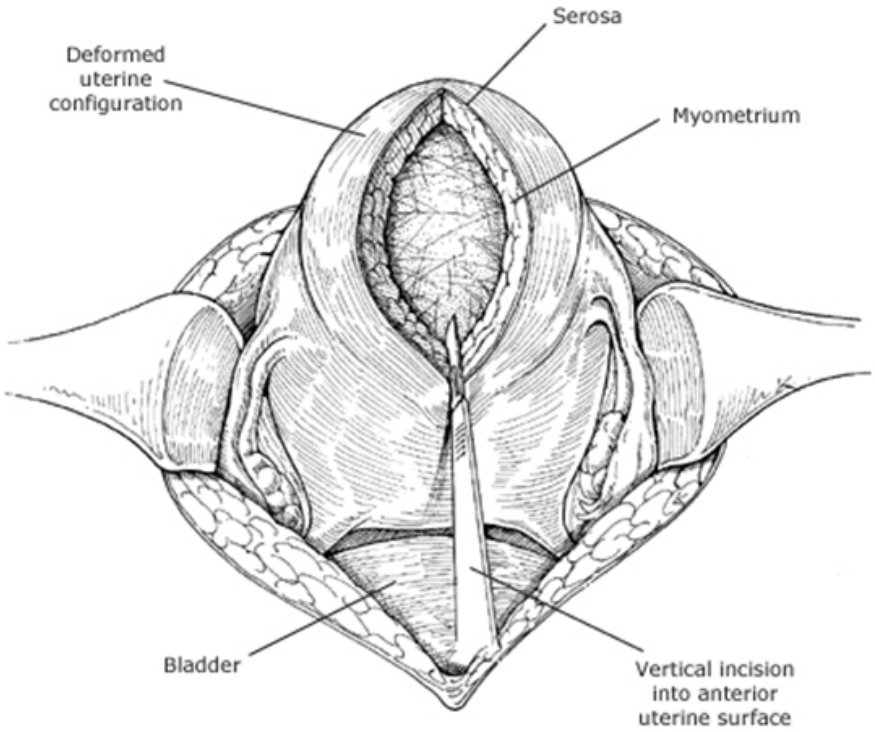


**Figure 2:** Vertical incision into the anterior uterine surface.

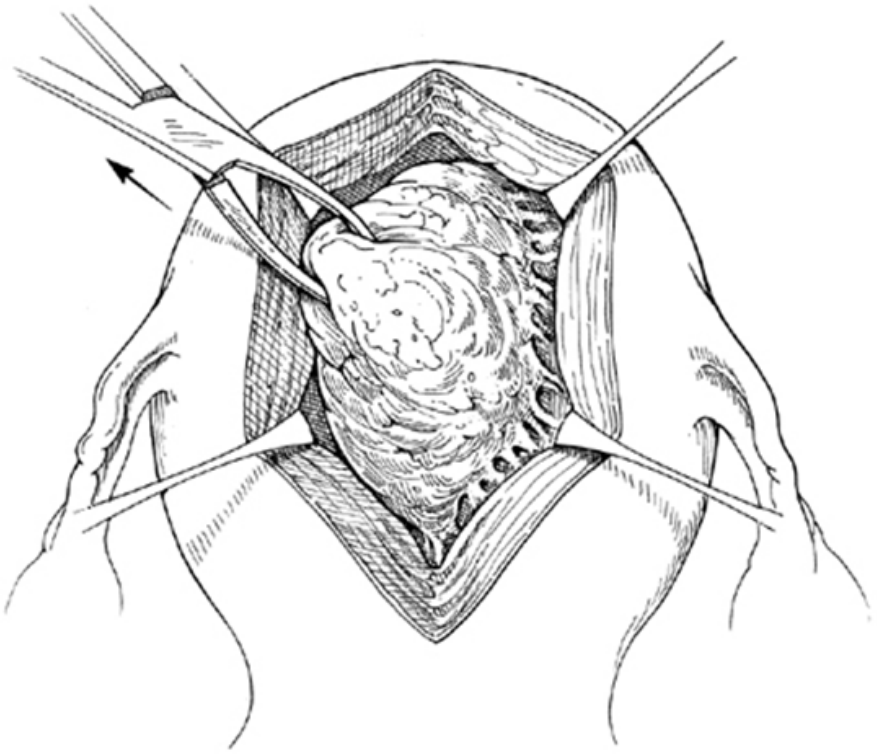

**Figure 3:** Dissection of myoma using a grasper.

**Closure of Wound bed:** The bipolar grasper is held on site on the non-dominant arm of the surgeon. The unipolar scissors are replaced by a needle driver. The suture material is introduced through the 8mm trocar using an atraumatic grasper.

Uterine reconstruction is performed in multiple layers with a continuous barbed suturing (V-lock 2.0) which does not require knotting. Other sutures, including polyglactin (Vicryl) can be used. There are no studies available that compare the use of those different sutures with regard to strength of the uterine wound. The serosa is ideally re approximated by a running suture. (Figure 4) We use a running inverted V-lock suture or by using monofilament continuous suture to prevent adhesion formation. The security of the closure may impact the risk of uterine rupture in subsequent pregnancy [10].

**Removal of Specimen:** The myoma can be removed either by morcellation (ideally in a bag to reduce risk of spilling) [11].

The morcellator (8 or 12 mm) is positioned in the suprapubic skin entrance, depending on the choice of size, a small enlargement of the skinincision is necessary. The dissected myoma can also be removed by performing a mini-laparotomy (to avoid as a significant enlargement of skin incision is necessary) (Figure 5).

## Laparoscopic Myomectomy

**Installation:** The patient is positioned in lithotomy position with the coccycal bone on the edge of the operating table. The installation is equal to the robotic myomectomy including the use of a uterine manipulator.

**Approach:** Unless the benign gynaecologic pathology is reaching until the umbilicus, the umbilicus is the easiest site of entrance to develop a pneumoperitoneum until 15mmHg using a verres needle or open laparoscopy. A 0 or 30 degree 12 mm laparoscope can be introduced after introducing a fascial layer plication (Vicryl 0).

The fascia should always be closed with a suture to reduce the risk of developing a port-site herna after placement of a port using the open (Hasson) technique or a port ≥ 12 mm is used [12].

**Instrument Choice and Position:** Once the pneumoperitoneum, maximum pressure 15 mmHg [13], is in place, a imaginary straight line can be drown from one superior iliac anterior spine (SIAS) to the umbilicus. Two 5 mm ports can be placed either right or left lower quadrant on 1/3 of the imaginary line or approximately 2 fingers distance from the SIAS, unless a more superior point is chosen after bimanual assessment. In that case the entrance position moves superior on the fictive straight line going from one SIAS to the laparoscope position. An additional 10mm port is placed suprapubically (Figure 6). Port sites created with a radially-dilating trocar (as opposed to cutting trocars) do not generally require closure unless larger than 12 mm in size [12].

**Instrument Choice:** With a unipolar scissors, atraumatic grasper, needle driver and energy instruments of choice ( like bipolar grasper or Harmonics, Thunderbeat,…) on the operating table, the procedure can start.

**Procedure of Myomectomy:** The surgeon stands on the left side of the patient with the dominant instrument positioned in the suprapubic port. A intracapsular myomectomy can be performed after subcapsular infiltration of terlipressine using the bipolar energy instrument of choice and the unipolar scissors.

The scissors can be used as a cutting device on the tip as well as a coagulation device. Hemostasis needs to be controlled at all times. Diffuse venous or arterial bleeding can be dissolved using the bipolar coagulation forceps. A irrigation device can be manipulated in the right lateral 5 mm port by the assistant to enhance control of the bleeding.

**Reduction of Blood loss [Robotic myomectomy 1.7]:** With intramyometrial injection of a vasoconstrictor such as terlipressin, a vasopressin analogue, blood loss during myomectomy can be significantly reduced (299 ml less compared to placebo) [8] and less than or comparable to use of a uterine artery tourniquet [9], temporary blocking blood supply. The maximum safe dose of vasopressin is not established. The half-life of intramuscular vasopressin is 10 to 20 minutes and the duration of action is two to eight hours. We use 0.4 mg of terlipressin diluted in 20 ml saline. Also epinephrine can be used to reduce blood loss, but it has a shorter half-life then vasopressin. Misoprostol was also found to reduce

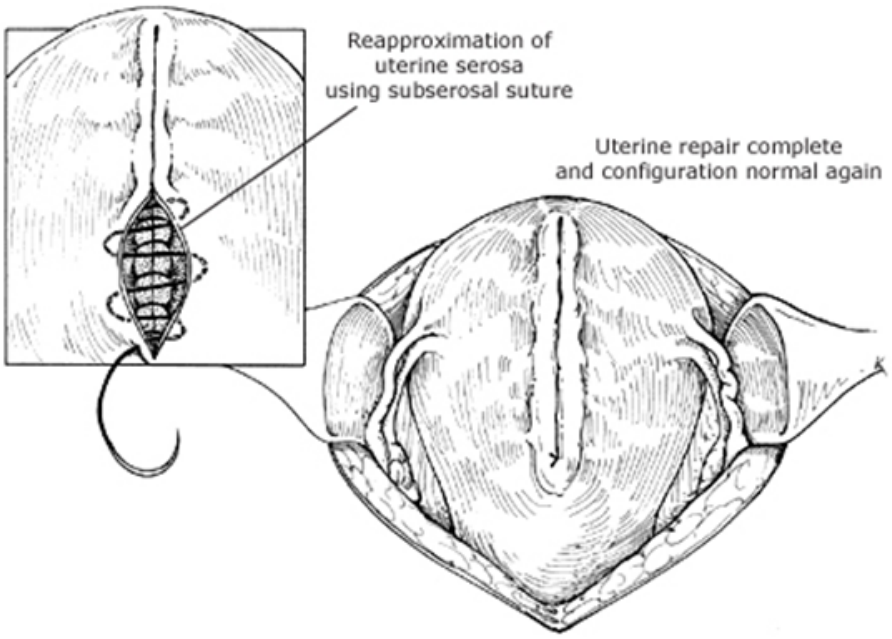


**Figure 4:** Re approximation of uterine serosa using subserosal suture.

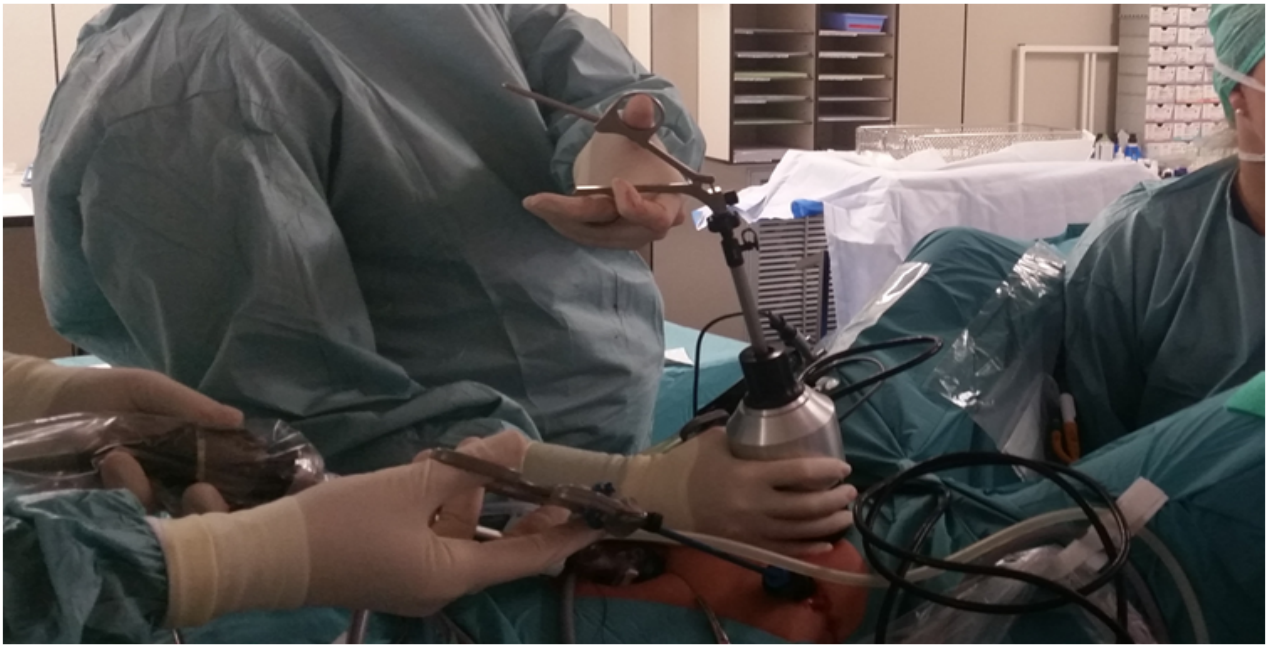

**Figure 5:** Morcellator.

blood loss, but data are limited. There seems no benefit with the use of oxytocin or tranexamic acid [8].

**Closure of Wound bed:** After dissection of the myoma, the energy instrument is changed to the needle driver. The needle driver can introduce the suture material through the 10 mm suprapubic port. Uterine reconstruction is performed in multiple layers with a running barbed suturing (V-lock 2.0) which does not require knotting. Other sutures, including polyglactin (Vicryl) can be used. There are no studies available that compare the use of those different sutures with regard to strength of the uterine wound. Subserous layer is ideally reapproximated by a continuous inverted V-lock suture or by using monofilament continuous sutureto prevent adhesion formation. The monofilament suture can either be knotted intra-abdominally or extra-abdominally using a knotpusher. The security of the closure may impact the risk of uterine rupture in subsequent pregnancy [9].

**Removal of Specimen [Robotic Myomectomy 1.7]:** The myoma can be removed either by morcellation (ideally in a bag to reduce risk of spilling) [11].

The morcellator (8 or 12 mm) is positioned in the suprapubic skin entrance, depending on the choice of size, a small enlargement of the skinincision is necessary. The dissected myoma can also be removed by performing a mini-laparotomy (to avoid as a significant enlargement of skin incision is necessary) (Figure 5).

**Figure 6:** Laparoscopic port placement

## Laparotomic Myomectomy

**Installation:** The woman is placed in a dorsal decubitus position. The surgeon stands on the side of the patient so that his/her dominant hand is cranial.

**Choice of Incision:** The incision necessary for laparotomy needs to be decided upon the properties of the uterus and myoma. Generally, a uterus reaching up to the umbilicus can be operated on through a Pfannenstiel incision.

**Instrument Choice:** Little instrumentation is necessary other than the classical instruments for a hysterectomy. We advocate the use of a bipolar forceps in order to minimize damage to the myometrium. To enucleate the myoma a surgical corkscrew can be used, but only when the capsula of the myoma is opened at the level of the myoma itself.

**Procedure of Myomectomy:** Exposure of the uterus is mandatory to locate the myoma properly. The uterus is palpated to locate the leiomyomas. Infiltration with terlipressin to reduce blood loss is always advocated in our experience.

For a pedunculated myoma a bipolar coagulation of the stem can be sufficient. In case of a large stem, the surrounding myometrium and serosa of the defect can be closed to prevent adhesion formation. Closure of the serosa should be carried using an absorbable monofilament suture (i.e. Monocryl®).

For an intracapsular myomectomy an incision in the myometrium should be made. As discussed previously [topic 2] a vertical incision will be made to respect the vascular architecture of the uterus and the insertion of the tubes in the cavity. Proceeding to the level of the myoma with continuous coagulation of the surrounding myometrium, will evidentially free the myoma.

**Closure of wound bed:** When the cavity is opened, the mucosa does not need to be sutured separately, but it can be helpful for large defects. We advocate the use of an absorbable monofilament suture. Closure of the myometrium with a continuous absorbable multifilament suture can be beneficial for a complete closure not to leave any space for accumulation of blood. Depending on the depth of the myoma multiple layers can be necessary. Closure of the serosa with an absorbable monofilament suture to prevent blood loss is preferred. A protruding serosa/uterine defect should be avoided as this is prone for risk of adhesion formation [7].

## Discussion

The aim of this article is to provide a practical manual of the potential surgical techniques for a myomectomy, anno 2018. One cannot advocate enough a correct indication of surgery is primordial in advance in order to reduce complication rate and risk of conversion [1,14].

In the beginning of this decade, robotic surgery has developed as a more technologically advanced form of minimally invasive surgery in order to improve patient outcome. Robotic surgery improves surgical precision due to its three-dimensional stereoscopic vision, wristed instruments and tremor cancelling software. Lots have been published regarding cost-efficacy of this technique. Latest Cochrane analysis states a lack of evidence based benefit of use of robotic surgery in gynaecology. More studies are needed to evidence based state the position of robotic assisted laparoscopic surgery in benign gynaecologic pathology. Robotic surgery has definitely conquered a strong position in complex cases however one can make a remark regarding surgeon case volume and secondary competence. As this technique is so advanced, adequate training of surgeons is primordial however a profound objective education programme/fellowship has not yet been enrolled.

At the moment minimal invasive approach (either laparoscopic or robotic) has proven to be superior over open surgery in benign gynaecological pathology [15]. There is a significant overlap in indication with laparoscopic approach, however in this topic of minimal invasive surgery, studies lack evidence of robotic ruling over laparoscopic approach, definitely in those complex cases that face conventional laparoscopic limits.

More studies are needed in order to enhance evidence based practice.

## Conclusion

A correct indication of surgery is primordial in advance in order to reduce complication rate and risk of conversion. At the moment minimal invasive approach (either laparoscopic or robotic) has proven to be superior over open surgery in benign gynaecological pathology. There is a significant overlap in indication with laparoscopic approach, however in this topic of minimal invasive surgery, studies lack evidence of robotic ruling over laparoscopic approach.

## Conflict of Interest

This research did not receive any specific grant from funding agencies in the public, commercial or not-for-profit sectors.

## Declarations of interest

None

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